THE VORTEX

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Mike Tucker, Speaker, March meeting

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THE VORTEX

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Chair's Message

Mark Frishberg

ACS – the only constant in your chemistry career.

That is the title of a presentation that I started to put together a few years ago when I was one of your Councilors and the Chair of the Membership Retention, Recruitment, and Benefits subcommittee of the ACS Membership Affairs Committee (MAC). If you have guessed that this is going to be a member retention and recruitment message, you have guessed right – but please read on, even if you do not think this applies to you.

The gist of the presentation was to be a review of the opportunities and experiences that the ACS afforded me early in my career, when I was a member and then Chair of the ACS Younger Chemists Committee (YCC), that aided in my professional development before I encountered similar situations at work – and how the ACS has since grown its portfolio of member benefits to replace and keep pace with the decline of employer offered professional training and personal services.

But I want to start this message even earlier in my career when I was an ACS student affiliate at Case Tech (really dating myself here). At the end of the senior year, the ACS student affiliate faculty advisors, Kerro Knox and Peter Kovacic, traditionally held a pizza party for the graduating chemistry majors. During my senior year, George Olah joined the faculty advisor group, as Case was in the process of merging with Western Reserve where he was at the time. At the end of the party each faculty member made a strong pitch for why becoming an active member of ACS and supporting the Society was what a professional chemist should do. This was back in the days when a prospective new ACS member needed two current ACS members to sign their application for membership. As the party ended, each senior was presented with a filled out ACS application and encouraged to apply on the spot. For those who have met George Olah, you can picture that he presented a pretty imposing figure blocking the exit to the room where the party was held. To the best of my knowledge every senior signed an application to become an ACS member that night – and can look back at having their ACS member application endorsed by a future Nobel Prize winner.

Unfortunately, this scene of chemistry faculty mentors instilling professional responsibility and encouraging ACS membership does not seem to play out much anymore, which is hard to understand in these precarious economic times, and much to the detriment of our younger chemists who

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SCIENCE CAFE

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SCIENCE CAFE:
The Art & Science of Disasters
Fires and Earthquakes and Asteroids, Oh My!
Tuesday, April 15, 2014

Meet at Lafayette's official emergency command center, also known as the LLLC Community Hall, to hear an altogether different perspective on the art and science of emergency preparedness and management.... from Lafayette to the entire planet (think asteroid!). There is more to it than just dialing 911.
Speakers: Fred Lothrop, Chair, Lafayette Emergency Preparedness Commission
Dr. Margaret Race, Senior Scientist, Planetary Protection, SETI Institute

WHEN: Tuesday, April 15, 2014
7:00pm - 8:00pm
WHERE: LLLC Community Hall
Reserve@LLLCF.org or (925) 283-6513 x.103
COST: $ 5.00 per adult

Boxed Meals Available for Pre-Purchase: $10 (non-refundable). Call the above number to order.
Beer, Wine, Beverages, Coffee & Cookies for sale in the Community Hall

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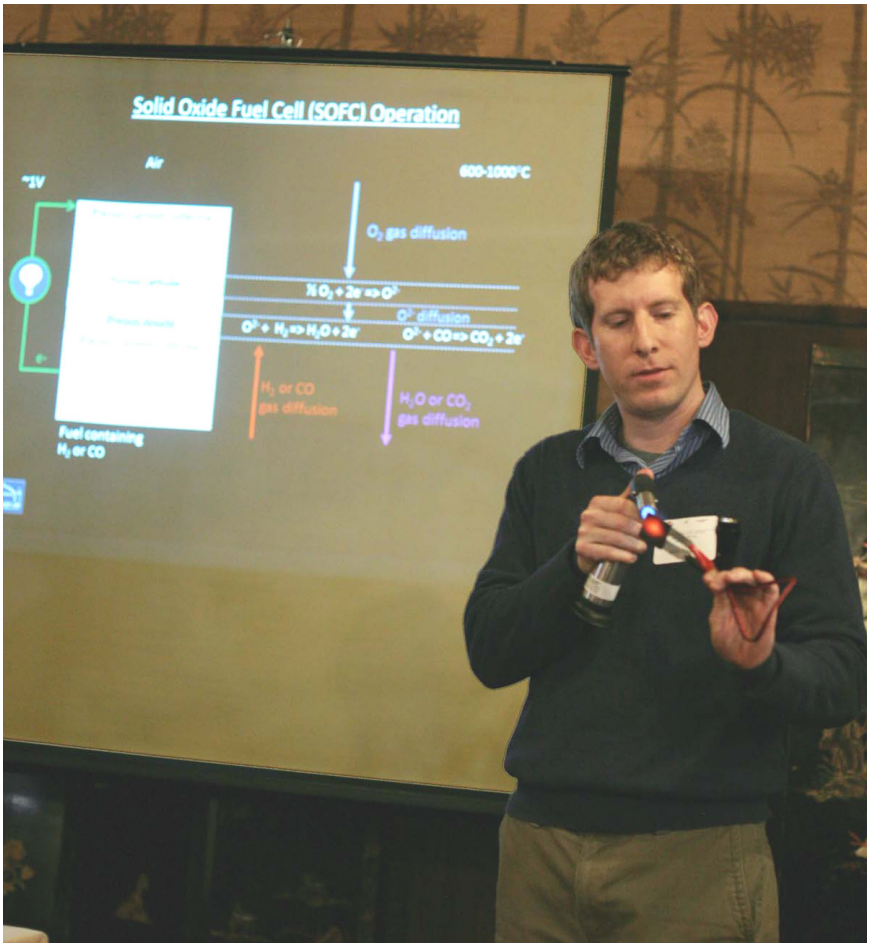
Call for Papers: San Francisco 2014

Submit your abstract today, to present your work at the 248th ACS National Meeting & Exposition, August 10-14, 2014, in San Francisco. The meeting theme is "Chemistry & Global Stewardship." This will be another great ACS National Meeting, in one of our favorite meeting cities!

Joint March Meeting Report Summary

The San Francisco Section of the Electrochemical Society and the California Section had a joint meeting on Thursday March 6, 2014 at the Mandarin Garden Restaurant.

The talk entitled "Cooking Up Some Electricity: Solid Oxide Fuel Cells for the Developing World" was presented by Mike Tucker, Staff Researcher at UC Berkeley. Dr Tucker received his PhD in Chemical Engineering from UC Berkeley in 2001. He has been working on electrochemical devices for 16 years, and fuel cells for 11 years. His current focus is



Dr. Mike Tucker

redox flow battery development for grid-scale energy storage and fundamental studies of transport in PEM fuel cells.

Over 1.4 billion people have limited or no access to electricity, and consequently pay significant portions of their income for kerosene lighting and retail mobile phone re-charging. Point Source Power has developed a unique Solid Oxide Fuel Cell (VOTO) that allows

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Fingerprinting Water (Part 1)

Bill Motzer

Two items prompted me to write a series of articles on why and how we identify different water sources: an announcement in the March 2014 Vortex on Celebrate Earth Day "Wonders of Water," (April 26, 2014) and the signing by Governor Jerry Brown of an emergency $687 million drought relief bill to address California's critical need for potable water. These items highlight the importance of our water sources. In the December 2013 Vortex, I described the use of stable isotopes of water (oxygen and hydrogen) to fingerprint different water sources. For example, water suppliers (e.g., water districts) may have to determine the water quality of: (1) a basin over a large geographical area, (2) trends over time, (3) groundwater source(s), or (4) all of the above. But many suppliers may not have ready access to stable isotopic analyses. In such cases they can use intrinsic (naturally-occurring) ions that are routinely analyzed to comply with U.S. EPA and California Department of Public Health drinking water maximum contaminant levels or MCLs.

To do this, one must be able to interpret water quality chemical analyses and plot data on appropriate diagrams that employ the major and minor ions typically analyzed in water quality investigations. Analyses

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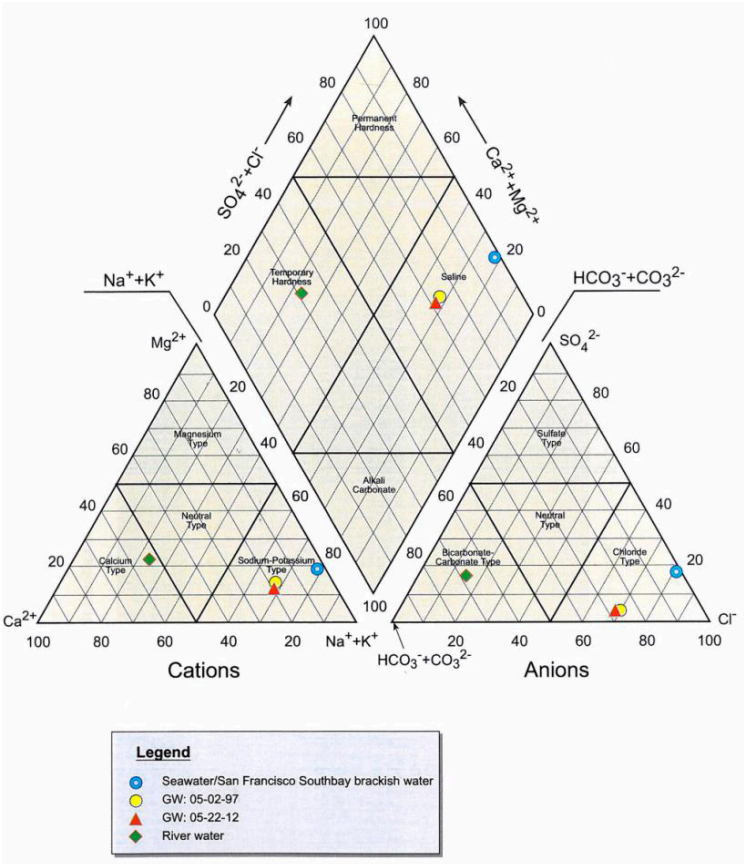

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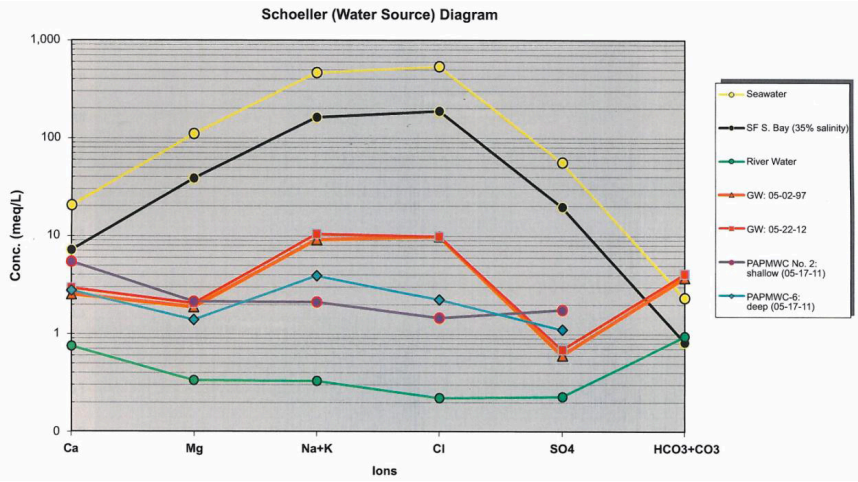
are generally returned in milligrams per liter (mg/L) or micrograms per liter (µg/L) and for many of the plotting techniques, the analytical data must be converted to millequivalents per liter (meq/L) or moles per liter (moles/L). However, such chemical data are virtually meaningless until they are analyzed and displayed through appropriate plotting techniques to display geochemical relationships and trends. In general, there are two types of graphical methods: (1) those that describe abundance or relative abundance of cations and anions and (2) those that present variability patterns; either illustrative or statistical. The most useful methods are described below.

Trilinear (Piper) Diagrams are plots recognized by most geochemists and used for comparing water quality analyses using intrinsic ions dissolved in water. In this type of diagram, cation (calcium, magnesium, and sodium+potassium) concentrations in meq/L are expressed as a percentage of total cations on a left hand triangle and anions (carbonate+bicarbonate, sulfate, and chloride+nitrate) concentrations in meq/L are plotted on a right hand triangle. The cation-anion plot is then projected onto a central diamond-shaped area that combines both cation and anion distributions. The intersection of the cation and anion lines can be drawn as a circle with its diameter proportional to the total dissolved solid concentration of the analysis. Groundwater with similar geochemistry will generally group together and can be classified (i.e., groundwater from different sources may be identified by their bulk chemical compositions). Trilinear plots are most useful in classifying different water types.

Water Source (Schoeller) Diagrams are *x-y* plots used to fingerprint different water sources. In many situations groundwater solute sources may be indistinguishable from surface water solute sources except perhaps in concentration levels. Schoeller diagrams can be used to identify these water sources. Log concentrations are plotted on the *y* axis in either mg/L or meq/L (as long as all are consistent) against ions on the *x* axis with cations (on the left) and anions (on the right). In the Schoeller diagram shown, note that water, derived from different sources (e.g., sea and brackish water) have different linear signatures than those of river water or groundwater (GW). Although the GW resembles a sea-brackish water source, the actual interpretation is that because magnesium and sulfate concentrations differ, depositional salts in the aquifer formation may be responsible. Additionally, you can still get a signature if some of your constituents (such as bicarbonate) are absent from the analyses.

In a future article I'll describe some other useful plots.



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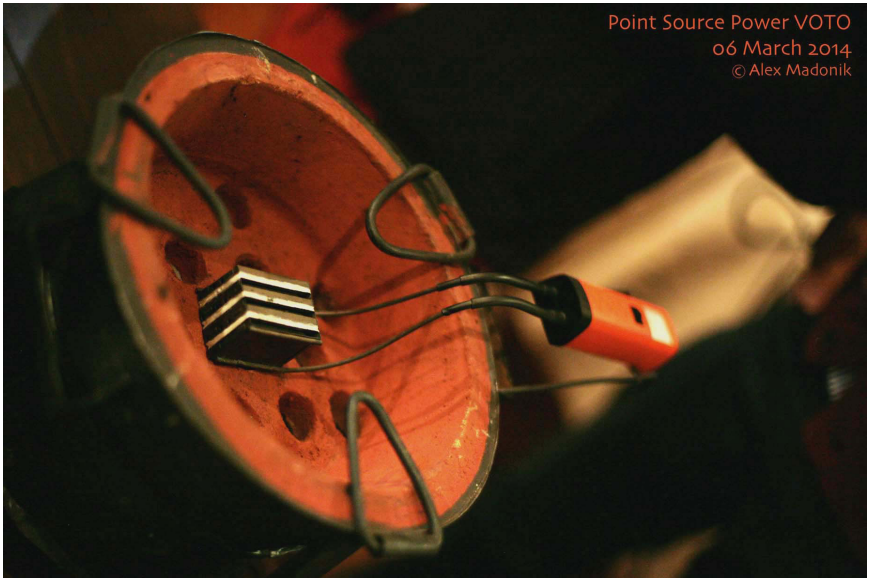

Photo A, cook box, with fuel cell

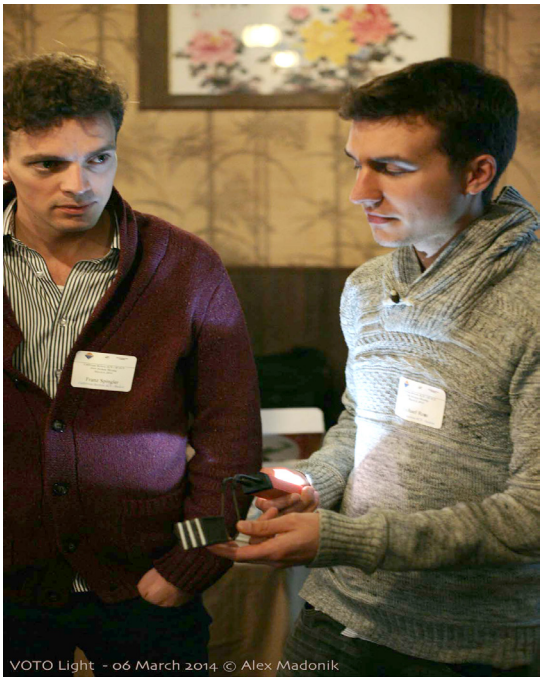

Photo B LED light as part of the fuel cell assembly

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individual end-users to generate small amounts of electricity in their own home as a by-product of cooking.

Shown in Photo A on the previous page, the device is placed in a cook box, covered with charcoal which is ignited when the fuel cell reaches the required 650-800°C operating temperature, the handle can then be removed from the sensor and used to charge cell phones or provide LED lighting (photo B).

Charcoal is converted to CO and Hydrogen, which sustain the electrochemical production of electricity. The user is thereby able to generate a few watt hours of electricity during cooking to be used for LED lighting and mobile phone charging in the home.

The device relies on metals-supported solid oxide fuel cell technology developed at LBNL. This innovative cell architecture is extremely rugged, tolerant to rapid heat-cool cycling, and capable of withstanding significant levels of contaminants in the air and fuel stream. These advantages make it perfectly suited for the demanding and uncontrolled environment in an operating cook stove. Numerous challenges were overcome in the development of this consumer product.

Some of the Joint March Meeting Audience

Chair from page 3

are missing the great networking potential within the umbrella of the ACS worldwide.

When I began my chemistry career, my image of the ACS was mainly about scientific meeting programming and scholarly publications. Now it has evolved to be that and much more people oriented. When new chemistry-related technical specialties arose, the ACS moved to include them. Hence we have journals such as "Nanotechnology" and "Bioconjugate Chemistry," among others. When companies began downsizing and new graduates found obtaining employment difficult, the ACS revamped its Employment Clearinghouse to become the Career Fair and institutionalize the resume reviews and mock interviews that the YCC was performing on an informal basis. Now there is an expanded offering of workshops on how to obtain information on industrial, academic, government, and entrepreneurial careers in order to decide one's career path. To assist unemployed chemists further, there are reduced or waived fees and dues for unemployed members. Insurance, investment, and other services are offered through the ACS so chemists can carry their own personal benefit package with them should they need or choose to move to new jobs.

With older chemists being pushed into becoming consultants in order to maintain professional employment, and academic chemists finding that they can supplement their incomes by presenting expert opinion in court cases, the ACS has developed a variety of liability insurance options. There are also discounts on rental cars, shipping, and travel services, to name a few. When companies began cutting back on internal professional development programs, the ACS developed its Professional Development series of workshops, teaching management and some of the "soft" skills needed to be successful in our current environment. With lobbyists promoting their employer's self-serving views in many scientific areas, ACS has become a source for balanced insight for government at all levels. With funding for science education dropping, the ACS has developed a series of educational and public outreach programs to help fill the gap, from Kids in Chemistry to National Chemistry Week, Chemists Celebrate Earth Day, Chemistry Ambassadors, and the Chemistry Olympiad.

Like attending an ACS National Meeting for the first time, with the ACS offering something for just about everyone, it is easy for new members to be overwhelmed, and not quickly find the programs, services, or personal connections that they need in order to justify the cost of continued membership. Data shows that members are most likely to leave the ACS during their first five years of membership, just when they should be using the ACS to establish themselves in the chemistry community. Data also shows that it is far less expensive to retain members than to attract new ones. My personal experience is that the best way to get and keep members is to connect with them on a personal level and show that their Local Section, Division, or National office cares about them and is willing to work with them to find their best fit within the Society. For those members or non-members who read this and still do not see anything in ACS for them, this is an invitation to engage with us to identify new programs that will meet their needs.

It is trendy to say that a professional will have at least seven job changes during their career. Hopefully, everyone appreciates that this does not mean that you will choose to make this many changes, but that you can expect these changes to be thrust upon you. I have had a series of job disruptions over the course of my career, many coming when I was performing at my highest level, but decisions were made by others that were out of my control. Now with a 40+ year career as a chemist as I started this message, I can truly say that ACS has been the only constant in my chemistry career. ACS is ready, willing, and able to be your constant as well. Make sure that you give the ACS, and yourself, a chance. If I can help in my capacities as Chair of the California Local Section and as an ACS Career Consultant and Presenter, please let me know.

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